History of the Double Skin Facade

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early double skins

Vernacular architecture in cold climates has long featured double skin windows. Storm windows, a combination of glass with usually a wood panel fixed on the exterior in particularly harsh weather, are the primary example of this. With the evolution of glass and steel technology, it seems in retrospect a logical conclusion that this system would be combined into a double layered wall.

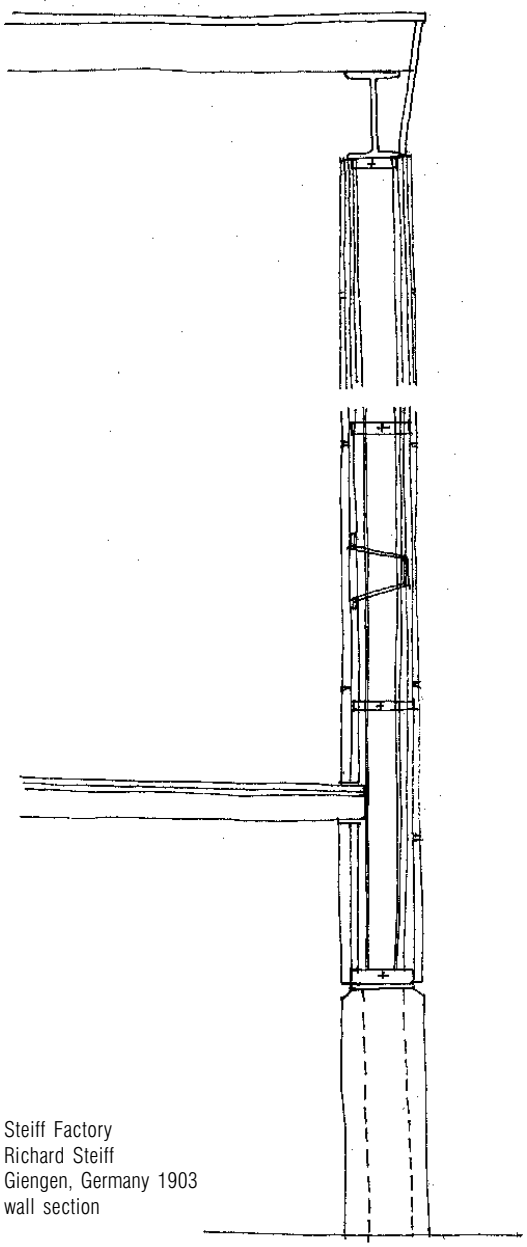
The first instance of a double skin curtain wall appears in 1903, in the Steiff Factory in Giengen, Germany. The building accomodates a toy factory, and was designed by Richard Steiff, the factory owner's son. The priorities were to maximize daylighting while taking into account the cold weather and strong winds of the region. The solution was a three storey structure with a ground floor for storage space and two upper floors used for work areas. The steel frame structure supports a framework of welded T-sections fixed with cleats to the internal and external sides of each column. This framework supports the two layers of the double skin, leaving a void 25cm wide. The only openings in the system are for maintenance purposes. The building was a success, and two additions were built in 1904 and 1908 with the same double skin system but using timber instead of steel in the structure for budget reasons. All buildings are still in use.

In 1903, Otto Wagner won the competition for the Post Office Savings Bank in Vienna, Austria. The building, built in two phases from 1904 to 1912, has a double skin skylight in the main banking hall. A steel structure holds the glass and aluminum skylight that occupies three of the five naves of the building. The building is still in use by the same owner. Renovations were made in the 70's to accomodate lighting, new air-conditioning ducts and changing uses of space.

At the end of the 1920's double skins were being developed with other priorities in mind. Two cases can be clearly identified. In Russia, Moisei Ginzburg experimented with double skin stripes in the communal housing blocks of his Narkomfin building [1928]. Although the project is mainly known for its manifestation of communist ideals and processes, Ginzburg was very interested in how to technically push the idea of the window. In the communal services block main elevation, a vertical truss system supports a curtain wall hanging in the inside and another on the outside. The building has greatly deteriorated, and at some point the double skin facade of the communal services block was altered to accomodate a garage and some office spaces with regular punched windows.

Also in the 1920's Le Corbusier was designing the Centrosoyus, also in Moscow. A year later he would start the design for the Cite de Refuge [1929] and the Immeuble Clarte [1930] in Paris. Although ultimately none of these buildings had double skin walls, all the initial projects included what Le Corbusier called the "*mur neutralisant*," a system of ventilated double glazing that was deemed too expensive and inefficient to be built.

Le Corbusier, who walked daily by the construction site of Pierre Charreau's Maison de Verre on the way to his office, was also visiting Russia extensively at the end of the 1920's in dealing with the Centrosoyus competition. In the course of one of these visits he met Ginzburg. The similarities between projects like the Narkomfin and the Cite de Refuge could be the result of the exchange that took place between these architects.



Steiff Factory
Richard Steiff
Giengen, Germany 1903
wall section

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ventilated double skins

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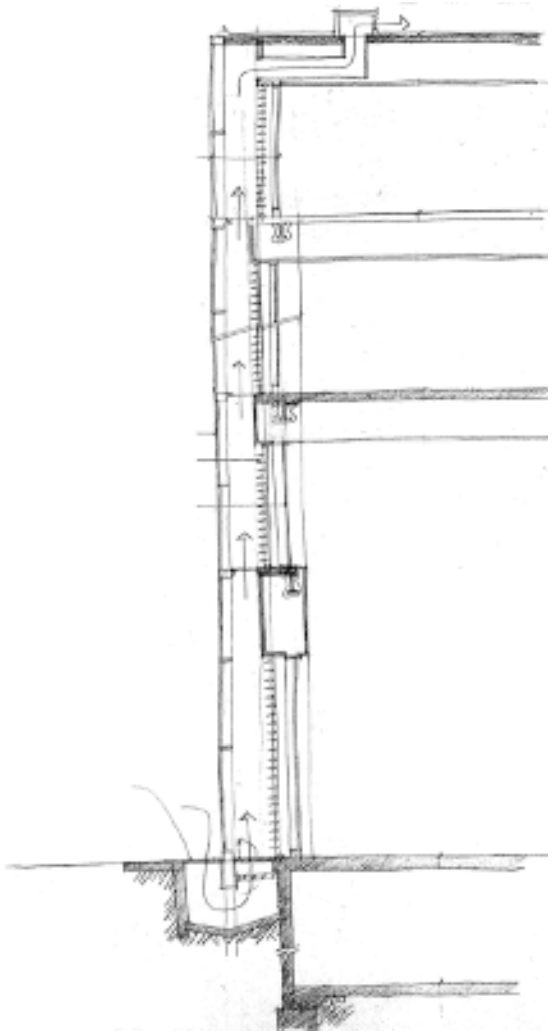
Little or no progress is made in double skin glass construction until the late 70's and early 80's. In 1978, Cannon Design in association with HOK designs the Hooker Office building in Niagara Falls, N.Y. This is the first instance of a built double wall that incorporates Le Corbusier's ideas in ventilation. The 8' deep cavity houses an off-the-shelf system of louvers, grouped in banks. On each bank, a louver has a solar cell that registers when the sun hits it and reacts by tilting the whole bank out of the sun. In this way, it bounces back sunlight and causes the louvers to collect radiative energy. The purpose is to cause a stack effect, with the warm air raising to the top were it is collected on cold weather and discarded on warm weather. The solar wall at the Solar Dairy at Mysen in Norway uses a similar system and was built at the same time.

Also in 1978, Richard Rogers and Partners start designing the Lloyd's Building in London. This building, completed in 1986, has fan-shaped terminals in the ground floor that allow air at the bottom of the double skin. The warm air rises to the top where it is collected by plant rooms and fed back into the system, effectively wrapping the building in its own air.

Double skin glass facades start gaining momentum in the 80's. Most of these facades are designed using environmental concerns as an argument, like the Offices of Leslie and Godwin (also known as the Briarcliff House) in Farnsborough, England, designed by Arup Associates in 1984. But in other cases, the esthetic effect of the multiple layers of glass is the principal concern. The SUVA building (Basel, 1993) designed by Herzog and De Meuron, isa renovation of an existing building that uses a layer of glass louvers to envelope both old and new buildings into a coherent unity.

In the 90's, two factors strongly influence the proliferation of double skin facades. The increasing environmental concerns start influencing architectural design both from a technical standpoint but also as a political inflluence that makes "green buildings" a good image for corporate architecture. The rapid development of hardware and software allows for highly complex calculations to shape the design of facades. These factors make double skin facades ideally suited for high-rise buildings, typically endowed with a big budget and a need for an environmentally friendly image. Other arguments often used are the fact that the double skin allows windows to be opened despite strong wind conditions in high floors combined with the increasing tendency to try to accomodate individual flexibility. Two very publicized examples are the RWE AG Headquarters by Ingenhoven, Overdiek Kahlen und Partner and the Commerzbank HQ by Foster and Partners, both completed in Germany in 1997.

The work of the Renzo Piano Building Workshop in the Potzdamer Platz development, with the Debis Tower completed in 1998, is a less extreme example of this tendency. While the firm did an extensive environmental analysis of the facades in the building, the project itself has an urban emphasis that among other things limits the height of the tower to 27 stories. The flexibility of the different layers, allowed also by this limitation in height, allows the skin to function more freely and adapt easily to individual concerns.



Hooker Building
Cannon Design
Niagara Falls, NY 1979
wall section

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layering skins

Another trend can be identified at the end of the 90's, one in which environmental arguments take second stage. In 1995, the Museum of Modern Art, New York organizes "Light Construction." This exhibition, curated by Terence Riley, focuses on architectural projects and installations where transparency is one of the main issues. Different layering strategies can be appreciated, such as Herzog and De Meuron's experimentations with glass and copper strips in the Signal Box auf dem Wolf, Peter Zumthor's layering of concrete and glass at the Kunsthaus Bregenz.

A fascination with transparency and layering is manifest in many projects built at the end of the decade. The prematurely called "minimalist architecture," in which formal concerns are discarded in favor of geometric abstraction, lead by architects of the ETH such as Peter Zumthor and Herzog and De Meuron, but also manifest in Japan, Spain and Chile, rapidly starts taking advantage of the esthetic effects of the layering of skins. In these cases, double skins start departing from the use of double glass and experimenting with different materials and levels of opacity, becoming more a reinterpretation of the cavity wall.

Additional formal explorations have been done concerning the geometry of the double skin, such as Frank Gehry's Nationale-Nederlanden office building (Prague, 1994). Also known as the Ginger and Fred building, the project manipulates the skin of the 'Ginger' tower into a morphing, curved plane. Gehry has further explored the curvature of glass in his design for the Conde-Nast Cafeteria in New York. Rafael Moneo uses a very different curved laminated glass for the double skin of the Kursaal Conference Center (San Sebastian, 1999). The Kursaal's outer layer is made of rows of tilted curved glass forms, which tilt three degrees off one horizontal axis and slope five degrees from the vertical. But considering this complexity, the asymmetrical joints are repetitions or inversions of one module, sharing the same custom element.

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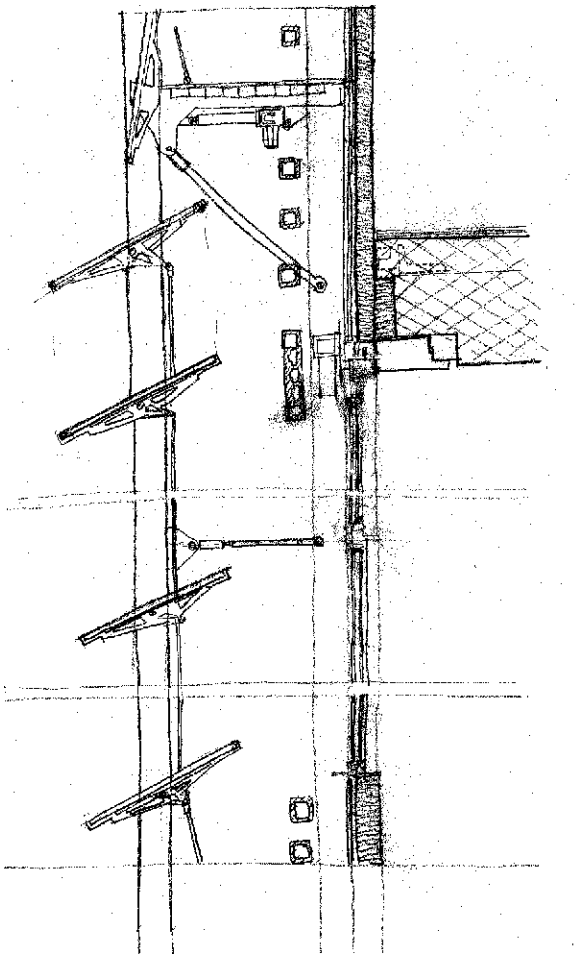

Debis Tower
Renzo Piano Building Workshop
Berlin, Germany 1998
wall section